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SHAPE OF THE CATHODE CURRENT PULSE AS A FUNCTION OF ACTIVITY OF--ETC(U)

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SHAPE OF THE CATHODE CURRENT PULSE AS A FUNCTION OF ACTIVITY OF AN OXIDE CATHODE

By

E. Yu. Kleyner, L. P. Smirnov, A. L. Tsekhanskiy

FOREIGN TECHNOLOGY DIVISION

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Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, shch
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ё in Russian, transliterate as yё or ё.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	sinh^{-1}
cos	cos	ch	cosh	arc ch	cosh^{-1}
tg	tan	th	tanh	arc th	tanh^{-1}
ctg	cot	cth	coth	arc cth	coth^{-1}
sec	sec	sch	sech	arc sch	sech^{-1}
cosec	csc	csch	csch	arc csch	csch^{-1}

Russian	English
rot	curl
lg	log

SHAPE OF THE CATHODE CURRENT PULSE AS A FUNCTION OF ACTIVITY OF AN OXIDE CATHODE

Cand. of Tech. Sci., E. Yu. Kleyner,
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A study of the behavior of a tube with an oxide cathode in the process of their operation under pulsed conditions has shown [1] that the shape of the current pulse taken from the cathode changes gradually with the operating time of the tube; there is a change in both the absolute value of change in the current in the period of the pulse and in the regularity of this change in the course of the pulse. It is possible to assume that these changes are connected, first of all, with a change in the activity of the cathode. The study of this connection is of interest both from the standpoint of clarification of the reasons, which cause the change in the cathode emission in the course of the pulse, and from the standpoint of finding an optimum set of parameters for the estimation of the quality of the cathode. This work is dedicated to the study of this question. It is convenient to conduct this study while the cathode is being conditioned, since the range of change in the cathode's activity, in this case, is very large.

1. Experimental procedure

The study was carried out by transmitting a rectangular voltage pulse, whose magnitude should allow the passage of the given

current through the tube, to the tube activated by a diode. In a general case, the magnitude of this current can differ from that of the emission current of the cathode. Subsequently, we will refer to this current as the load current of the cathode. The change in the emission current was recorded simultaneously with the shape of the load-current pulse during the duration of the pulse.

This is accomplished by means of the pulse sounding method, according to which, short pulses (τ=2 μs), the so-called sounding pulses whose voltage is equal or somewhat exceeds the saturation voltage are transmitted to the tube during the load pulse. The installation described in [2] was used for the pulsed sounding.

In the course of measurements we recorded the relative changes in the emission current $\Delta I_e/I_{e0}$ and the loading current $\Delta I_н/I_{н0}$. in the course of the pulse, where ΔI_e and $\Delta I_н$ - absolute changes in the emission current and the load current, respectively, in the pulse, while I_{e0} and $I_{н0}$ - emission current and load current at the beginning of the pulse. All measurements were accomplished under the conditions of a single action. In order to have the possibility of comparing these variations with the state of the device as a whole, we determined the grid-plate transconductance S, underheating transconductance S_H, anode current with the grid voltage equalling zero I_{a0}, pulsed emission I_{e0}, noise anode current $I_{aш}$, and inverse grid current $I_{c\,обр}$.

The study was carried out on the metal-ceramic triodes of the type GI-12B. The cathode had a tricarbonate coating with the density of 1.5–1.9 g/cm^3 and thickness of 45–55 μm, the core of the cathode - nickel LMN. With a nominal heating voltage (12.6 V) the cathode temperature was 1070–1100°K. Under the condition of a continuous generation, a typical electrical mode was as follows: U_H=12.6 V; U_a=800 V; and I_a=100 mA, which corresponds to the density of the cathode current of 260 mA/cm^2.

The conditions under which the drop in currents was measured on the pulse-sounding installation were as follows: the duration of the load pulse - 7 ms, current amplitude of the load pulse - 1 A (space charge mode), voltage of the sounding pulses - 120 V. electrical measurement modes of the remaining values are presented

in [3]. All measurements were made at certain periods of time whose value was established depending on the mode of conditioning and the duration of its individual stages.

2. Results of the experiments

The studies were carried out at three different conditioning modes:

1) in a generation mode at the wavelength λ=26 cm at the average density of the cathode current component j_k=130 mA/cm^2.

2) in a static mode with the drawing of current with the average density of the cathode current j=300 mA/cm^2 and three voltage values (15, 16, and 17 V),

3) in a static mode without the drawing of current with the heating voltage values of 15, 16, and 17 V. At least 5 tubes were tested in each of the indicated versions.

The nature of change in all the values determined with respect to time was similar in all cases; depending on the conditioning mode, the curves are, more or less, extended in time. A typical course of change in these values with respect to time is presented in Fig. 1 for the conditioning in a static mode with the drawing of current. As can be seen, the values S, S_H, I_{a0}, I_{am}, and I_{s0} pass through a maximum and, in this case, all simultaneously. Simialr data were obtained also in [3]. The time at which the maximum is achieved is, apparently, an optimum time for the cathode conditioning. Simultaneously with the maximum of these values we observed a minimum of relative change in the emission and load currents in the course of the pulse. Thus, there is a certain correspondence between the magnitude of the drop in the emission and load currents in the course of the pulse and the change in the other determined parameters, depending to a certain degree on the activity of the cathode.

3. Discussion of the results

The course of change shown in Fig. 1 for the value $\Delta I / I_{s0}$ with the conditioning time is apparently connected with the following processes which occur simultaneously. On one hand, in the course of conditioning, there is an increase in the average value of the

emission current and a more uniform distribution of it along the surface of the cathode, which is supported by the time dependence of the value $I_{\text{э0}}$ and $I_{\text{эш}}$. On the other hand, in the same time, the degree of poisoning of the cathode decreases in the course of the pulse due to constant cleaning of the anode by an electronic bombardment. Both these processes lead to a decrease with the conditioning time in the value of relative change in the emission current in the course of the pulse. The curves of change in $\Delta I_{\text{к}}/I_{\text{к0}}$ virtually coincide with the corresponding curves for $\Delta I_{\text{э}}/I_{\text{э0}}$. An identical relative change in the emission and cathode currents under the conditions of a space charge is possible only if we assume that with the poisoning of the cathode the perveance of the device changes. The possibility of change in the perveance, as a result of poisoning of the cathode in the case of devices with the distributing cathodes, is indicated in [4]. Apparently, such an occurrence can take place also in the case of oxide cathodes since, according to [4], there is a little difference between the distributing and oxide cathodes with regard to the structure of the emitting layer. An argument in favor of the possibility of change in the perveance under the effect of a gas atmosphere in the tube can also be the so-called 10-volt effect [5], consisting of the fact that, when approaching the anode voltage values of 10 V, a delay in the build-up or even a decrease in the anode current is observed on the volt-ampere characteristic in the diodes with an oxide cathode.

Conclusion

It follows from these experiments that there is a definite correlation between the activity of the cathode and the magnitude of drop in the cathode current in the course of the pulse; thus, the value of decrease can be used to estimate the cathode's activity. The sensitivity of the decrease to the degree of activity is comparable to a corresponding sensitivity of shot noises.

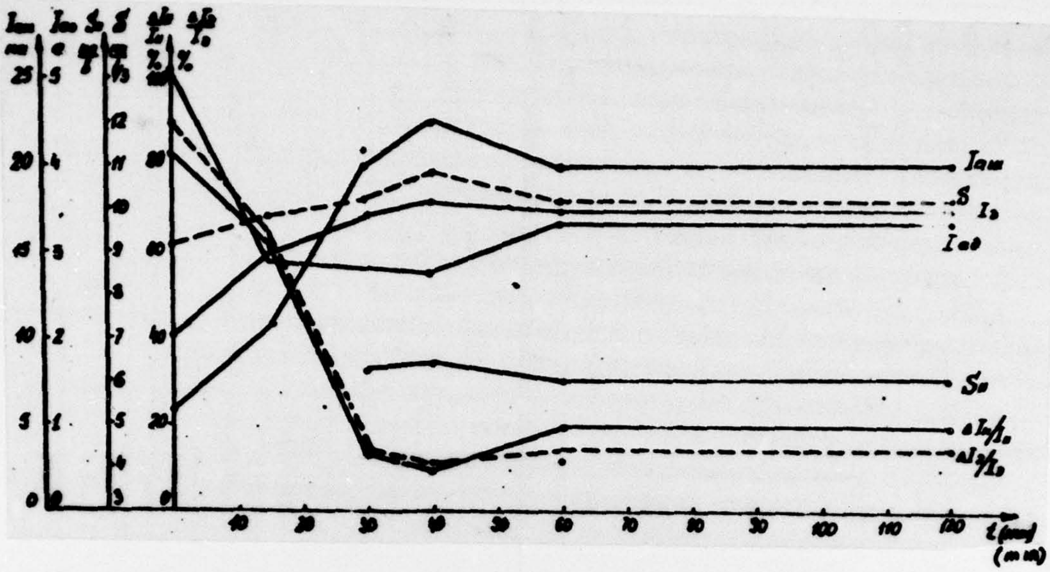

Fig. 1. Determination of the parameters and a drop in the load and emission currents during conditioning in a static mode with the drawing of current at U_H=15 V. Tube GI-25B N02595-92.

BIBLIOGRAPHY

I. Клейнер Э.Ю., Цехановский А.Л. Доклады научно-технической конференции по итогам научно-исследовательских работ за 1968–1969гг., секция электронной техники, подсекция электронных приборов, МЭИ, 1969 г., 89.

2. Клейнер Э.Ю., Цехановский А.Л., Иванов Ю.А." Электронная техника", серия У, 1968 г., № I.

3. Клейнер Э.Ю., Амирян Р.А., Смирнов Л.П."Электронная техника", серия I, 1967 г., № 5 104.

4. Дружинин А.В."Радиотехника и электроника", 1962, 7, № 9, 1547.

5. Моргеорд Л.С. сб. "Оксидный катод" под ред. Добрецова Л.Н. ГЭИ, 1957, 5.

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